NEWS RELEASE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
400 MARYLAND AVENUE, SW, WASHINGTON 25, D.C.
TELEPHONES: WORTH 2-4155 —— WORTH 3-1110

FOR RELEASE: ON DELIVERY
8:00 P.M.
Wednesday, October 23, 1963

Address
by
James E. Webb, Administrator
National Aeronautics and Space Administration

MICHIGAN INDUSTRY-UNIVERSITY RESEARCH CONFERENCE
Detroit, Michigan
October 23, 1963

* * *

The opportunity to participate in this conference is one which I greatly appreciate. Its very title--Industry-University Research Conference --indicates that you understand the direction in which your future lies. To those of us who work with national programs in scientific research and technological development it is becoming increasingly apparent that the maximum return from our investment will be realized only through close co-operation between the nation's universities, and the business and industry of the areas which they serve. The fact that the industrial and educational leadership of Michigan are working together to capitalize on the opportunities of this new scientific age is significant evidence of your determination to maintain your position of leadership as one of the great industrial states of the nation.

Several phenomena of the last 20 years are transforming the Industrial Revolution of the past into the Scientific-Technical-Political-Economic Revolution of today. Among these are the growing dependence of our national security and economic welfare on basic scientific discoveries and their applications; the fast and accelerating pace of technological change, with the incident shortening of the time-lag between scientific discovery and its practical application; the increasing need of the federal government to develop acceptable and efficient means to sponsor essential scientific research and development; and the clear evidence that not only the U.S.S.R. but other nations are setting a fast pace on the road toward effective and often secret exploitation of science and technology for national power and aggressive challenges to the U. S.

In 1940, just prior to World War II, the total federal expenditure for research and development was still under $100 million a year. Spurred by the requirements of modern warfare, this annual investment had grown to $3 billion by 1955, and has since risen to almost $15 billion included in President Kennedy's budget for Fiscal Year 1964. Private industry is investing an additional $5 billion of its own resources in this activity, bringing the total national investment to $20 billion a year.

Obviously, the investment of sums of this magnitude has an economic impact of its own, but the direct impact may well prove to be of less significance than the potential, realized after some time-delay, of this research.

Altogether 38 agencies of the executive branch of government and almost every major business are engaged in research activities. There are many areas in which new knowledge is being discovered, and I think it is significant to note that when research and development executives in major U. S. corporations were asked by the Wall Street Journal to name science's "Top Ten Conquests" in the last decade, they listed seven in which federal scientists made key contributions. Federal programs use industrial resources wherever possible, but require enough competent scientists and managers to define the needs and plan and monitor the business.

A look at the problems being attacked in space research illustrates the broad front along which advances in science and technology must be made, many of which have application in business and industry as well.

We must substantially improve our propulsion systems. We must devise reliable means for supplying large amounts of internal electrical power for spacecraft. We must develop instruments and life-support systems that will operate unattended and without maintenance for long periods. And we must improve our equipment and techniques for transmitting and receiving great quantities of data over vast distances.

The success of our space program is dependent upon rapidly increasing the efficient use of energy; the development of new materials, metals, fabrics, and lubricants which can withstand wide ranges of temperature, vibration, radiation, and vacuum; the most advanced electronics; and the marriage of all of these with life sciences.

Although the research we are conducting in these fields is intended to facilitate space exploration, these are the very same areas which underlie and determine economic growth.

For this reason, it has been said, today's businessman needs to know more about high and low temperature materials than his father knew about steel. The executive whose understanding of materials is limited to basic metals and simple plastics may well expect to find his more alert competitor passing him by. And the same may be said said for the new processes and manufacturing techniques developed in space research.

But how can the businessman know what he needs to know about a research effort so vast that there are published each day, worldwide, scientific papers in quantity sufficient to fill seven complete <u>sets</u> of the Encyclopedia Britanica--60 million pages throughout the world each year?

How can he extract what he needs to know from even one scientific discipline in an era in which, for example, a young chemist who decided to spend his life reading the literature of chemistry would fall ten years farther behind during each year of effort?

How can we so act as to insure that the continuing expansion of knowledge, the accelerating rate of technological progress will continue to be a boon to mankind and not a burden?

Let's start with two thoughts of critical importance which I am sure will be expressed many times, in many ways, during this conference. The first of these is the need to create favorable conditions compatible with the American private enterprise system through which the knowledge which we gain and the skills which we develop in our national research and development program are identified and made available for use in the industrial stream to contribute to economic growth and to our nation's power to survive in a world where second best is more severely penalized than ever before.

The second thought is closely interrelated with the first. It concerns a necessity for developing viable relationships between science, education, industry, and government. These are necessary for the utilization of research results for productive purposes, to create the legislative framework needed to meet needs of our time, and to bring into effective use the wisdom of the economists and other social scientists.

One obstacle in the path of prompt application of today's research is the extent to which scientific effort has gone beyond the experience of most citizens. Therefore, in the Space Agency, while our specific responsibility is the achievement of United States goals in space, at the same time we are not unmindful of the fact that the applicable knowledge gained must be utilized to further economic growth.

A substantial investment is being made in space research, and when federal funds are invested in any undertaking our citizens have the right to expect returns. It is apparent that if such returns are to come many must stem from the nation's universities--the one community in which all of the disciplines are brought together, where knowledge is used to train the workers and leaders of the future, and where competence exists to evaluate the potential for utilization beyond space inherent in the scientific research and technical development now underway.

In my reading recently, I encountered a quotation written more than half a century ago. It reads:

"Nothing in our educational history is more striking than the steady pressure of democracy upon its universities to adapt them to the requirements of all the people...

"In the transitional conditions of American democracy...the mission of the university is most important. The times call for educated leaders. General experience and rule-of-thumb information are inadequate for the solution of the problems of a democracy which no longer owns the safety fund of an unlimited quantity of untouched resources...

"The test tube and the microscope are needed rather than the axe and the rifle in this new ideal of conquest. The very discoveries of science in such fields as public health and manufacturing processes have made it necessary to depend upon the expert."

Many of you will recognize those words as coming from Frederick Jackson Turner. Although this great scholar's concern was more with the solution of social problems growing out of the early industrialization of society, the language applies with equal force to the problems of today. How, in an increasingly technical age, can the business and industry of the nation remain abreast of the enormous volume of new knowledge which is becoming available in science and technology? How, indeed, except by turning to the university and its scholars as a trusted source of information? Such trusted sources are hard to find in our society, but are indispensable to our peculiarly American decision making processes.

Dr. Lloyd Berkner put it very well when he wrote that, as a result of the technological revolution which began about 1950, "the graduate university has suddenly been brought to the very focus of future community welfare. The graduate school must provide the technology leaders and the ideas from which industrial employment and community happiness must flow. The university is no longer a desirable appendage to community life; the university today must be at the very center of community development; it must work as an integral part of the community if society is to survive as a productive and happy group of citizens."

Nowhere, in this scientific age, is Berkner's point more clear than in the NASA program. Unlike many of the large, government-sponsored research and development programs of the past, much of our space program is unclassified. Moreover, under the law, NASA is required to consult with the scientific community in the design of its experiments, and to report to the nation's scientists on the results.

As a consequence, in an era of diverse, complex and extensive research in every scientific and engineering discipline, the nation's institutions of higher learning have become virtually the only center in which the emerging mass of scientific and technical knowledge can be gathered, understood, and disseminated to those who will find it of value, and need to trust its source.

Within NASA, we have sought to encourage closer relationships between our university partners and the business, industry, and government leaders of the regions which they serve. It is our policy to place research contracts and grants at those universities where the scholars themselves, the consensus of the faculty, and the administration of the university are interested in having the work progress on a broad inter-disciplinary basis.

Further, in those instances in which grants are made for the construction of research facilities, the university must agree to undertake to create in an energetic and organized manner, a broadly based multi-disciplinary team to explore means of feeding research results into the industries and segments of the economy with which the university normally has close relations.

In addition to these policies, NASA has also developed a technology utilization program in which a group of universities and research institutes are studying potential means through which the burgeoning knowledge of the present age can be more effectively transmitted into the economic life of the country. Although barely underway, this program offers promise of being of real value in the years ahead.

These policies can, we believe, increasingly create situations within which the interdisciplinary groups working with us in the universities, if joined with other forces for progress and growth in the community, can lay the base for more rapid assimilation and use of new knowledge gained from space research.

It is certainly clear, however, that no activity which NASA itself can undertake, no policy which it can establish will effectively insure that the nation derives maximum benefit from space related research unless the nation's universities and industries join together and assume a position at the very heart of economic and social progress in the years ahead. Modern industry has much to gain from regional cooperation in support of the universities and associated research efforts. Successful industrial leaders are beginning, more and more, to look to the universities of their region for the most important resource of the age--ideas, scientific brainpower, and advanced technological skill, experience, and judgement.

Similarly, if these means are to be effective, there must be a feedback into these intellectual institutions from the entrepreneurial mind of the practical businessman, the man who under our system must take the risk for profit or loss, and his associate, the experienced engineer who must see that things--even new things--work and give service.

As this becomes more fully realized, those regions and businesses which are quickest to comprehend the significance of this tide of change, and move with it will be in the forefront of progress and prosperity during the years ahead.

One other fact is clear, when one reviews the nation's first five years in space. The systems and concepts of management being developed will contribute significantly to business and industrial operations in future years. The Wall Street Journal, reporting on Major Gordon Cooper's flight, said:

"Yesterday (the space age) stepped over an invisible line...the invisible line between the adventurer pushing into the unknown and true professionals setting forth into chartered seas. This was the impression which by the end of the day had overridden all others. The awe at the moment of blast-off, the marvel at listening to a man in space above Australia, these things contain their wonders. But the greatest wonder...is that these things should pass from fantastic adventure to the commonplace routine of man."

With the completion of Project Mercury and the accompanying vigorous forward movements toward the successful completion of Projects Gemini and Apollo, patterns of management have emerged which offer to the United States power which is almost as vital and important as the demonstrations of space power in flight.

We realize that as a nation we are going through a new and vital experience in achieving the mastery of space. In terms of technical requirements, the U. S. Manned Space program involves about 20 times the complexity of the Minuteman program. But this job is underway, and rapid progress is being made. We have undertaken to perform the largest job of research, of development and of manufacture ever attempted by this or any nation. There is required here the mobilization of the best efforts in these areas.

The national ability proven in the successful mobilization of these efforts is a clear indication of national strength and this strength is currently being both emphasized and demonstrated in our national space program. The task of bringing together a strong university-industry-government team, of doint 90 per cent of business in industry, of managing large contracts, which fan out into vast sub-contracting operations, of doing research with 4,000 to 5,000 experimenters on college campuses and in research institutes, and in continuously arranging cooperation between scores of government agencies, is complex and difficult. It means that to do the best and most efficient job, to deliver this extra strength, an agency must constantly examine its management structure to see if it is doing the best job.

After Project Mercury, the National Aeronautics and Space Administration began a careful reassessment of its management capabilities. Steps have been taken to get on with the job at the very highest level of efficiency. We have attracted more men to the agency who are thoroughly experienced in our nation's previous ballistic missile and space programs and who have the confidence of their colleagues within the government and without.

Dr. George Mueller, a vice president of Space Technology Laboratories, one of the pioneers in the development of the ballistic missile program, has joined NASA to head the manned space flight program. Dr. E. B. Doll, also of Space Technology Laboratories, has joined the agency in a six-month management improvement effort in manned space flight. Robert Young, one of the industry's finest propulsion authorities and a vice president of Aerojet General, is now working at Huntsville with Dr. von Braun on the big boosters. They join a respected team of proven performance. Reorganizational plans have been set in motion at Huntsville, Cape Canaveral, and Houston, as well as in the Headquarters manned space flight office.

The agency has clearly demonstrated its ability to attract this kind of top flight talent from industry and its flexibility in being able to make the necessary management changes to strengthen a program at the very time it is making its greatest strides forward.

Let us examine briefly what is included within the $20 billion cost that has been estimated for this program.

One of the major costs is related to the development of large launch vehicles and their rocket motors. It is estimated that $7 billion will be expended in this area. This development effort is well underway. The new engines utilizing the hydrogen technology and the giant 1.5 million pound thrust F-1 engine already have been operated during the course of their development.

The development in this area, however, has a far greater importance than supporting a manned lunar landing. The development of launch vehicle lifting capabilities equivalent to those of the Saturn family of vehicles is essential to the ability of this country to successfully support future operations in space. We have already learned the lesson that the magnitude of a nation's capability in space is measured by the payload capability of its launch vehicles. This nation must never again find itself in the position of lacking the capability to launch large payloads into space.

A second major area of cost related to the manned lunar landing program is that involved in development of the manned spacecraft. This cost, which amounts to $6 billion includes the two-man Gemini and the three-man Apollo spacecraft with the module that provides its service functions as well as the two-man excursion module that will be used to land men on the surface of the moon.

Like the launch vehicle and propulsion systems the work on these components is well underway. The Gemini and Apollo command and service module system will not only prove out an extensive capability for space flight and train the crews, but will also have many uses in the future for near-earth manned space operations. Consequently, they represent the next logical step in the development of manned spacecraft.

Also required for a manned lunar landing mission are the various supporting operations both on the ground and in space. The cost of this supporting effort is estimated at $7 billion. Included are about $2 billion for facilities needed to test and launch the large vehicles and spacecraft being developed. This amount represents a capital investment by this nation in its future capability to operate in space and it is thus necessary to support the development of our large launch vehicle capability.

Successful development of manned operational capability in space also requires support from other space flight operations both manned and unmanned. Approximately $1.5 billion of the estimated support funding falls in this area. Included are Project Mercury, which is already completed, as well as the lunar probes Ranger, Surveyor, and Orbiter, and the Orbiting Solar Observatory.

The remaining funds in the support area, \$3.5 billion, provide for equipping and operating the world-wide manned flight net and paying the salaries of the government employees and the expenses associated with operation of the development centers that support the launch vehicle and spacecraft development.

From the outset, in addition to recognizing the urgency of a hard-driving U. S. effort in space, those most intimately concerned with re-establishing leadership have recognized that it could be achieved only through a sustained, steadily accelerating effort.

Dr. T. Keith Glennan, the first Administrator of NASA, said it well in his testimony at the first NASA budget hearings before the House Committee on Space and Astronautics. He warned:

"As I see it, success of our national space program depends on three factors: Time, money, and effort. We are behind the Russians on the time scale because they have bigger boosters. We shall have to spend large sums of money and work harder to attain our space goals as soon as we want.

"This past year, we have shown we can move, but we have only started. The need is for urgently sustained effort for years to come. If our space programs are to be run on an off-again, on-again basis, zigging and zagging with the turn of every new year, then we'd better spend our money buying telescopes to watch the Russians pioneer in space."

Continuity is a prime virtue in any large-scale research and development program. The impact of the space program on the economy--and on many other areas of our national life--could well produce unhealthy or unbalanced growth instead of stimulating a broad-based advance if the effort is not carefully planned and carried out.

Stop-and-go programs resulting from short-term reactions to current situations are by their very nature wasteful. A consistently supported level of effort over a long period of years is essential if we are to employ federal funds and industrial resources efficiently, and if we are to take full advantage of the creative abilities, skills, and enthusiasm of our scientists and engineers.

In the years ahead, we can expect continuing and necessary debate on the rate and "mix" of the space investment and on when to freeze designs and begin development of boosters and spacecraft for specific missions. It is extremely important that we strive to maintain a well-balanced effort, duly recognizing the potential returns from manned exploration, scientific investigations, practical applications, and possible military uses of space, with a substantial share of attention to basic research in each area.

If this debate is to serve the best interests of the country, it is essential that every citizen of influence, whether editor, businessman, scientist, professor, government official, or military man, study and analyze all the principal reasons for a well-balanced, fast-paced space effort. The scientist who thinks only of scientific results or the businessman who looks only for economic results or the writer who seeks only for the spectacular or controversial will not be making his most constructive contribution to the process of national decision making in this vital manner.

What is required, in the national interest, is a judicious evaluation of our national opportunities in space and an efficient, sustained implementation of those we choose. We have the opportunity to lead mankind beyond the planet earth, out into the universe. If we are to insure our security and our position as leader of the Free World, and gain the scientific and economic benefits which space will surely produce, it is an opportunity we cannot afford to neglect.

# # #